Multidrug-resistant *Pseudomonas aeruginosa* strains in Tehran Reference Burn Hospital, Tehran, Iran

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*Pseudomonas aeruginosa* is one of the most common causes of burn wound infections. The aim of this study was to determine the frequency of antibiotic resistance burn morbidity during September 2005 to October 2007. The incidence of multi-drug resistant *P. aeruginosa* infection was indicated in 9238 patients admitted to Tehran Reference Burn Hospital. Specimens were collected after admitting the patients in the hospital wards. Susceptibility test were performed for all isolate. Specimens were collected based on hospital policy and cultures were performed on each patient. Isolated strains were identified by using standard bacteriological methods for isolation and identification of the causative agents. *P. aeruginosa* was identified in 3012 (70.5%), *Staphylococcus aureus* in 581 (13.6%), *Acinetobacter* 426 (9.9%), the rest organisms were 279 (6%). Frequencies resistant of applied antibiotics were tobramycin (82%), ceftazidim (78%), ceftizoxime (82%), ciprofloxacin (72%), amikacin (73%), gentamycin (80%), tetracyclin (60%), teazabactam (61%) and cotrimoxazol (98%), respectively for *P. aeruginosa*. Due to the high multi resistant rate in pseudomonas infection, there is need to immediately revise the hospital policy in control of nosocomial infection and treatment strategy such as more efficient antiseptic agents or new antibiotics used to reduce the rate of multidrug resistant.

Key words: *Pseudomonas aeruginosa*, multidrug resistant, Tehran Burn Reference Hospital.

INTRODUCTION

Resistance to antimicrobial agents is a global problem with the particular level of resistance. Yet, the problems posed by antimicrobial resistance in the burn population are not limited to a few microorganisms (Khosravani et al., 2008). Besides the Gram-positive microorganisms, a number of Gram negative bacteria are losing their susceptibility to mainstay antibiotics, as well (Rastegar 1998; Simor et al., 2002). Ceftazidime resistant pneumonia increased from 0 to 16.6%. Cefoperazone and ceftazidime resistant *Enterobacteriacea* were up to 22%. Also 13% of the *P. aeruginosa* were resistant to cefoperazone (Obritsch et al., 2005; Lee et al. 2006). As resistance develops, out breaks occur. Burn victims are obviously at high risk for nosocomial infection due to the nature of the burn injury itself. Bacterial infections in burn patients are widely known. The time related changes in the predominant flora of the burn wound from Gram-positive to Gram-negative recapitulate the history of burn wound infection. Selection and dissemination of intrinsic and acquired resistance mechanisms increase the probability of burn wound colonization by resistant species such as *P. aeruginosa* (Bonomo and Szabo, 2006; El'Garch, 2007; Lister et al., 2009).

However, everything from minor out-breaks to major epidemics of antibiotic resistant, *P. aeruginosa* remains frequently reported as a multi-resistant organisms (Hajia, et al., 2008; CLSI, 2006) with major cause of burn injury colonization and serious wound infections, which have been reported in Tehran Reference Burn Hospital as well as Burn Centers around the world (Hussein et al., 1989). The purpose of this study was to assess resistant pattern of applied antibiotics in admitted patients at Tehran Reference Burn (TRB) Hospital.
MATERIALS AND METHODS

**Studied group**

A retrospective study was conducted during September 2005 to October 2007 on burn patients who were admitted in Tehran Reference Burn (TBR) Hospital. In the present study, a total 9238 admitted patients were examined for bacteriological investigation during study period. Those patients who had positive culture with *P. aeruginosa* was considered in this study.

**TBR Hospital policy for admitting patients**

The policy of our burn hospital is to admit male patients ≥ 20% total body surface area (TBSA) burns. These patients are mainly burned by different kinds of burning agents such as electrical and chemical contacts, or burning fire. The first step for admitted patients is to apply Silver Sulphadiazine topically on the burnt patients after sampling which is the hospital policy for admitted patients at the burning ward. Dressing was also changed daily. Cephalothin and Amikacin were administered as first line of antibiotics from the first day of admission in-patients with ≥ 20% TBSA burns (II and III degrees). The wound was inspected daily during the dressing changes. The data gathered in the study was stored and processed by a computer database.

**Specimens and sampling procedure**

All wound and blood specimens were collected by sterile swabs from registered patients.

**Culture and isolation**

All samples were cultured on sheep blood agar and Eosin methylene blue. All isolated organisms were identified by using standard bacteriological protocols (Winn et al., 2006).

**Antimicrobial susceptibility test**

The antimicrobial activity against *P. aeruginosa* and other organisms was tested with the disk diffusion method of Kirby-Bauer recommended by clinical laboratory standard institute (CLSI, 2006) using available paper disc (Hi-Media). Applied standard organisms: Following organisms were used as quality control strains. Organisms for quality control of disk diffusion method were *E. coli* (ATCC 25922), *S. aureus* (ATCC 25923), and *P. aeruginosa* (ATCC 27853). Standard organisms for checking the quality of the Mueller-Hinton medium were the above mentioned organisms plus *Enterococcus faecalis* (ATCC 29212) (CLS1, 2006). The used antibiotics were as follow: amikacin, gentamicin, tobramycin, ceftazidime, cefetoxime, trimethoprim/sulfamethoxazole, ciprofloxacin, tetracycline, and tazabactam.

**RESULTS**

Among 9238 microbiologic samples, which were taken during the study period, bacterial strains were isolated and the frequency of *P. aeruginosa* (3012 strains) was found to be 70.5%. This was followed by *Staphylococcus aureus* (581 strains) 13.6%, *Acinetobacter* (425 strains) 9.9%, with other microorganisms (279 strains) 8%.

*P. aeruginosa* were isolated from either wound or blood samples of all these patients. These patients were aged up to 72 years old with the mean 34.2 ± 20.18.

Quality control of disk diffusion were performed each time of running the test to ensure reliability of applied antibiotics with *E. coli* (ATCC 25922), *S. aureus* (ATCC 25923), and *P. aeruginosa* (ATCC 27853) as it was mentioned in materials and methods.

The frequency of resistant *P. aeruginosa* strains was 60 to 98% for the examined antibiotics in 3012 isolates. 82% of the isolates were resistant to tree and 80% was resistant to 5 or more antibiotics. The lowest and highest frequency rate was observed in Tetracycline (60%) and Cotrimoxazol respectively (98%) (Figure 1).

**DISCUSSION**

*P. aeruginosa* was the most common pathogen causing wound infection compatible with other reports, especially from developing countries (Hajia et al., 2008; Rahbar 2010). There was a significantly higher mortality rate in the *Pseudomonas* group (33% vs. 8%, p < 0.001) compared with other isolated organisms. Amount of blood products used, length of stay, number of surgical procedures and the cost of care were all significantly higher in the *Pseudomonas* (Armour et al., 2007). In our burn hospital the high incidence of *P. aeruginosa* infections and the widespread of high resistance to antibiotics, may be one of the most important influences on the mortality rate in burned patients.

Comparison with report of Shahid and Malik (2005) studied in India; their multi-resistant rate was reported higher than this research. Owlia et al. (2006) has studied similar study in Tehran. He also reported slightly higher resistant rates for various antibiotics than our data such as tobramycin (93%), amikacin (95%), ceftazidime (95%), cefetoxime (94%) and ciprofloxacin (99%).

Burns continue to be a major environmental factor responsible for significant morbidity and mortality in developing countries (Weber and Rutala, 1999). The key to control antibiotic – resistant pathogens in the burn hospital is rigorous adherence to infection control guidelines and prevention of antibiotic misuse. Antibiotic restriction policies clearly result in reduced drug costs. Prevention strategies are based on developing a program to prevent or reduce antimicrobial resistance. It indicates the necessity for urgent measures to be taken to restrict the spread of the species in the units and to limit administration of antimicrobial agents including; complete isolation of the contaminated patients, applying highly effective disinfectants and hygienic procedures. The Society for Health Care Epidemiology of America / Infectious Disease Society of America (SHEA / IDSA) guidelines have reviewed specific methods to implement antibiotic control policies. The goal is that, all patients to receive the most effective drug with least toxic effect, and
least costly antibiotic for the precise period needed to
cure or prevent infection (Weber and Rutala, 1999).

Factors affecting the increase and dissemination of
antimicrobial resistance can be divided into transfer of
resistance genes from one microbe to another, and
mutation of existing genes to more resistant variants by
the over–use and misuse of antimicrobial, increase
infection control measures. Recently researchers have
noted to Molecular typing methods to find out about
resources of the nosocomial infections. Pulse field gel
electrophoresis has been reported successfully for this
purpose (Lambiase et al., 2009).

Besides, hospital staff might consider monitoring used
antibiotic with its resistance pattern and then de creasing
the use of specific antimicrobial agents (Wang et al.,
2003; Winn et al., 2006). The careless health care
workers are often the main vectors to promote the
dissemination of nosocomial infections.

Conclusion

Analysis of results revealed high multi resistant rate in
pseudomonas infection, although is lower than similar
report from Iran. Therefore, it seems revision of hospital
policy for more control of nosocomial infection and
treatment strategy is still required as applying more
efficient antiseptic agents or new antibiotics.

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